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BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte CLARK E. LUBBERS,
KEITH D. WOESTEHOFF, MASAMI Y. HUA,
RICHARD P. HELLIWELL, RANDY L. ROBERSON,
and ROBERT G. BEAN

Appeal 2009-005093
Application 10/043,924[1]
Technology Center 2400

Decided: May 28, 2010

Before LEE E. BARRETT, JEAN R. HOMERE, and
ST. JOHN COURTENAY III, *Administrative Patent Judges*.

BARRETT, *Administrative Patent Judge*.

DECISION ON APPEAL

This is a decision on appeal under 35 U.S.C. § 134(a) from the final rejection of claims 1-18. We have jurisdiction pursuant to 35 U.S.C. § 6(b).

We affirm-in-part.

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[1] Filed October 22, 2001, titled "System and Method for Interfacing with Virtual Storage." The real party in interest is Hewlett Packard Development Company.

STATEMENT OF THE CASE

The invention

The invention relates to a management of a virtualized storage system. Storage virtualization generally refers to systems that provide transparent abstraction of storage at the block level. In essence, virtualization separates out logical data access from physical data access, allowing users to create virtual disks from pools of storage that are allocated to network-coupled hosts as logical storage when needed. Virtual storage eliminates the physical one-to-one relationship between servers and storage devices. The physical disk devices and distribution of storage capacity become transparent to servers and applications. Spec. ¶ 0008.[2]

The user interface implemented by prior network storage controllers implemented the logical-to-physical mapping. As physical disks were added to, removed from, failed, or otherwise became inaccessible, the logical-to-physical mapping had to be updated to reflect the changes. An object of the invention is to provide a mass storage system in which a user interfaces only to virtual entities and is isolated from the underlying physical storage implementation. Spec. ¶ 0012.

The invention provides "logical disks" which are a virtualization of physical storage capacity. "Logical disk objects 722 are the fundamental storage unit accessible by the storage management system and are analogous to physical disk drives in prior storage management systems." Spec. ¶ 0057.

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[2] We refer to the paragraph numbers of the Specification as filed.

"Virtual disks" are created from these logical disks and the virtual disks are managed through a management interface. "One feature of the management system in accordance with the present invention is that it creates these virtual disks from logical disks rather than from physical disks as was done by previous systems." Spec. ¶ 0022. *See* claim 1.

The "virtual disk object" may comprise a "SCVD disk object," a "derived disk object," and a "presented disk object" in addition to the "logical disk object." Spec. 0055; Figure 8. The SCVD object provides specified virtual disk performance behaviors. Spec. ¶ 0060. The derived disk object adds protocol personality. Spec. ¶ 0061. The presented disk object provides an association between a storage cell client object (e.g., a host) or a group of storage cell client objects and a derived disk. Spec. ¶ 0062. *See* claim 14.

Figures 1 and 2 show a storage pool 101 having an arbitrarily large quantity of storage space. Within pool 101, logical device allocation domains (LDADs) 103 are defined. LDADs correspond to a set of physical storage devices from which virtual disks 102 may be allocated. Spec. ¶ 0027. For example, LDAD 103 may have four to several thousand disk drives. Spec. ¶ 0034. *See* claim 9.

Illustrative claims

Independent claims 1, 9, and 17 are reproduced below.

1. A system for managing virtualized data storage, comprising:

a virtualized logical disk object representing a virtual storage container, wherein the virtualized logical disk is an abstract representation of physical storage capacity provided by plurality of physical stores; and

a virtual disk object representing a virtual storage container, wherein the virtual disk object is an abstract representation of one or more virtualized logical disk objects, the virtual disk object including an exposed management interface; and

wherein the virtual disk object is managed through the management interface to select the one or more logical disk objects represented by the virtual disk object.

9. A method for managing virtual storage in a storage area network, the method comprising:

providing at least one network storage controller coupled to a plurality of physical disk drives implementing physical storage capacity;

creating a physical store object representing each of the plurality of physical disk drives;

specifying at least some of the plurality of physical disk drives for inclusion in a storage cell;

creating a storage cell object representing the storage cell wherein the physical store objects corresponding to the specified physical disk drives are included in the created storage cell.

17. A method for facilitating management of virtual storage in a storage area network enabling a user can flexibly present a virtual disk to a host, comprising:

connecting a host to a network storage controller (NSC) via a host agent capable of communicating command-response traffic with logical objects implemented in the network storage controller;

creating a logical disk object representing a virtual storage container, wherein the logical disk is an abstract representation of physical storage capacity provided by plurality of physical stores;

adding a storage protocol to the logical disk object using a derived disk object in response to a user protocol selection;

associating the derived object with a host using a presented disk object referencing the host agent in response to a user host selection; and

creating a virtual disk object comprising the logical disk object, the derived disk object and the presented disk object.

The reference

Lagueux	US 6,538,669 B1	Mar. 25, 2003 (filed Jul. 15, 1999)

The rejection

Claims 1-18 stand rejected under 35 U.S.C. § 102(e) as being anticipated by Lagueux.

PRINCIPLES OF LAW

"Anticipation requires the presence in a single prior art disclosure of all elements of a claimed invention arranged as in the claim." *Connell v. Sears, Roebuck & Co.*, 722 F.2d 1542, 1548 (Fed. Cir. 1983).

FINDINGS OF FACT

Lagueux relates to management and configuration of storage transactions in intelligent storage area networks (ISANs). Col. 1, ll. 23-25.

Storage area networks (SANs) connect a number of mass storage systems in a communication network which is optimized for storage transactions. Col. 1, ll. 37-42. An SAN is optimized to provide high bandwidth and high throughput storage for client computers such as file servers, web servers, and end user computers. Col. 5, ll. 21-26. An ISAN server provides additional functionality beyond data storage and retrieval such as storage routing and virtual device management. Col. 5, ll. 26-29.

Figure 2 shows a block diagram of an ISAN server having connection options 130 including a set of communication interfaces adapted for users and other data processing functions, and storage options 128 including a set of communication interfaces adapted for storage devices. Col. 6, ll. 21-38.

Lagueux provides a user interface for use in configuring a storage server for management of storage resources. Col. 1, l. 66 to col. 2, l. 1. The

user interface includes tools to configure virtual devices and virtual circuits, having a logical address such as a logical unit (LUN) number and target device identifier, to a set of physical storage devices coupled to communication interfaces in the storage server. Col. 2, ll. 22-27.

Lagueux describes storage transactions using Logical Unit Numbers (LUNs), which provide "logical addresses." Col. 3, ll. 12-15. For example, as described at column 7, lines 50-60, using the SCSI-3 protocol, each storage device has an identifier (ID), the machine issuing a storage request is called the initiator, and the machine responding to the request is called a target. The SCSI-3 protocol also provides for two addressing components of a LUN and an address. A LUN specifies a subcomponent of the target ID, so that two devices might share an ID but have different LUNs. The address is the address where data is to be read from or stored to.

Lagueux describes that software components are implemented as device driver modules (DDMs). A DDM that primarily services requests for a hardware device is termed a hardware driver module (HDM). A DDM that serves as an internal, intermediate program is termed an intermediate service module (ISM). Col. 12, ll. 13-19. An ISM that performs a mirror management data path task is shown in Figure 9. Logic 652 communicates with a plurality of drive interfaces including primary, secondary, tertiary, and standby drives. Col. 14, ll. 24-43. Figure 12 shows a mirror function with interfaces to four disks, (01)-(04). Col. 15, ll. 35-44.

Lagueux describes that users may specify the storage elements that will be part of an array. Col. 25, ll. 34-46.

REJECTIONS

Claims 1-8

Issue

Does Lagueux teach "a virtualized logical disk object . . . , wherein the virtualized logical disk is an abstract representation of physical storage capacity provided by plurality of physical stores" and "a virtual disk object . . . , wherein the virtual disk object is an abstract representation of one or more virtualized logical disk objects," as recited in claim 1?

Analysis

It is important to understand that the claimed invention involves two distinct elements. "Logical disks" are a virtualization of physical storage capacity and "virtual disks" are created from these logical disks. That is, "[o]ne feature of the management system in accordance with the present invention is that it creates these virtual disks from logical disks rather than from physical disks as was done by previous systems." Spec. ¶ 0022. Appellants acknowledge that it was known to create virtual disks from physical disks. ¶ 0008. The question is whether Lagueux has two levels of abstract representation.

In the Final Office Action (FOA), the Examiner appears to rely on the LUN for both the logical disk and the virtual disk. FOA 2-3. Appellants argue that a single LUN cannot be both elements. Br. 9-10. Appellants argue that Lagueux does not describe a virtual disk object which is an

abstract representation of a logical disk and therefore also does not disclose that a virtual disk object is managed. Br. 11-12.

The Examiner modifies the interpretation of Lagueux to find that ISAN server 102A corresponds to a virtual disk object and a LUN corresponds to a logical disk object, referring to column 2, lines 22-27. Ans. 6-7. The Examiner refers to column 22, lines 66-67 for the claimed management interface. Ans. 7.

Appellants reply that nothing in column 2 of Lagueux teaches that the ISAN server 102A provides an abstract representation of virtualized logical disk objects or that it manages a virtual disk object. Reply Br. 3-5.

Initially, we agree with Appellants that a LUN cannot be both a logical disk object and a virtual disk object since this would read limitations out of the claim. The Examiner does not explain how Lagueux teaches creating virtual disks from logical disks and we do not find this teaching in Lagueux. A LUN specifies a subcomponent of the target ID, which indicates that a LUN is an abstract representation of the physical storage, not of a logical disk. We find no teaching of then creating a virtual disk from a LUN logical disk as would be necessary to meet the claim language. The ISAN server maps a SCSI-3 storage transaction request to a LUN, but we find no teaching of the ISAN server creating virtual disks from the LUNs as the Examiner apparently contends. Appellants describe that a LUN can be a virtual disk which is an abstract representation of physical storage, Spec. ¶ 0032, but the claims require that the virtual disk is an abstract representation of a logical disk, which is not taught. Lagueux is a relatively

complex reference that does not specifically relate to Appellants' invention; therefore, a more extensive explanation is required to show how the claim language is anticipated. Manifestly, if there is no virtual disk object which is an abstract representation of a logical disk object, there can be no management of the virtual disk object as claimed.

Conclusion

Lagueux does not teach "a virtualized logical disk object . . . , wherein the virtualized logical disk is an abstract representation of physical storage capacity provided by plurality of physical stores" and "a virtual disk object . . . , wherein the virtual disk object is an abstract representation of one or more virtualized logical disk objects," as recited in claim 1. Accordingly, the rejection of claim 1 and dependent claims 2-8 is reversed.

Claim 9-16

Claims 9-12

Issue

Does Lagueux teach "specifying at least some of the plurality of physical disk drives for inclusion in a storage cell" and "creating a storage cell object representing the storage cell wherein the physical store objects corresponding to the specified physical disk drives are included in the created storage cell," as recited in claim 9?

Analysis

The Examiner finds that column 15, lines 20-45 of Lagueux teaches "specifying at least some of the plurality of physical disk drives for inclusion in a storage cell" and the storage device in columns 8-9 and Figure 24 corresponds to "creating a storage cell object representing the storage cell wherein the physical store objects corresponding to the specified physical disk drives are included in the created storage cell." FOA 4.

Appellants argue that the rejection appears to assert that the LUN meets the "specifying" limitation and that nothing in column 15, lines 20-45 teaches the "specifying" limitation. Br. 18. Appellants argue that nothing in columns 8-9 and Figure 24 teaches the "creating" limitation. Br. 18-19.

The Examiner finds that specifying certain disks for a mirror function corresponds to "specifying at least some of the plurality of physical disk drives for inclusion in a storage cell." Ans. 9. The Examiner finds that a virtual circuit is created when conditions are met and the ISAN server is the storage cell, which meets the limitation of "creating a storage cell object representing the storage cell wherein the physical store objects corresponding to the specified physical disk drives are included in the created storage cell." Ans. 9.

Lagueux describes that "[t]he storage objects are accessed from the mirror function 1013, and consist of a set of physical storage interfaces." Col. 15, ll. 25-27. A mirror module may consist of four drives (primary, secondary, tertiary, and standby) as shown in Figure 9, discussed at column 14, lines 24-43, which is shown as interfaces to four disks, (01)-(04),

in Figure 12, although only disks (01), (02), and (04) are used in the example. Col. 15, ll. 35-44. We see no reason why these four physical disks in Figures 9 and 12 cannot be considered to form a mirror storage cell, where the disks necessarily have to be specified to be part of the storage cell. Lagueux also expressly describes that users may specify the storage elements that will be part of an array, col. 25, ll. 34-46, where an array is considered a "storage cell object" as broadly claimed.

Conclusion

Lagueux reasonably teaches "specifying at least some of the plurality of physical disk drives for inclusion in a storage cell" and "creating a storage cell object representing the storage cell wherein the physical store objects corresponding to the specified physical disk drives are included in the created storage cell." Therefore, the rejection of claim 9 is affirmed. Dependent claims 10-12 are not separately argued and, accordingly, the rejection of claims 10-12 is also affirmed.

Claims 13-16

Appellants argue that the Examiner errs in relying on Figures 4 and 6 of Lagueux for claim 13. Br. 19. The Examiner actually relies on columns 16-18, but without any explanation. FOA 5. The Examiner refers to disk array 132 and column 8, line 23 in the Answer. Ans. 10.

It is not understood how the Examiner considers the drive array to teach "verifying that at least four physical store objects were specified before creating the storage cell object." Claim 13 is a method claim and

requires a method step of "verifying." The mere presence of multiple store objects does not teach this step. Thus, although Figures 9 and 12 show multiple storage disks as discussed with claim 9, there is no teaching of "verifying" and it cannot be said that such a step is inherent. Accordingly, the rejection of claim 13 is reversed.

Similarly, claims 14-16 depend on dependent claim 10 and each recite a step of "verifying" something. The Examiner's final rejection and discussion in the Answer do not point out where these method steps are taught in Lagueux. Thus, the rejection of claims 14-16 is reversed.

Claims 17 and 18

Issue

Does Lagueux describe "creating a logical disk object . . . , wherein the logical disk is an abstract representation of physical storage capacity provided by plurality of physical stores," "adding a storage protocol to the logical disk object using a derived disk object in response to a user protocol selection," "a presented disk object," and "creating a virtual disk object comprising the logical disk object, the derived disk object and the presented disk object" as recited in claim 17?

Analysis

The limitations of "creating a logical disk object" and "creating a virtual disk object" parallel the limitations of claim 1, but the Examiner relies on slightly different reasoning. As to "creating a logical disk object," the Examiner relies on creating LUNs. FOA 5. The Examiner refers to

columns 2 and 3 for the "derived disk object," and refers to columns 21 and 22 for the "presented disk object." FOA 5. As to "creating a virtual disk object," the Examiner refers to Table 1, the Export Table, and Table 2, referring to columns 17 and 18. FOA 5-6.

Appellants argue that the Examiner errs in relying on LUNs as both elements. Br. 22. It is argued that columns 2 and 3 provide no support for the "derived disk object." Br. 23. Appellants argue that Table 1 merely illustrates addressing information that can be used to request access to a virtual circuit and Table 2 illustrates mapping virtual devices to supporting device drivers, and the rejection provides no support for the assertion that this portion of Lagueux meets the claim limitations. Br. 23.

In the Examiner's Answer, the Examiner finds that hardware driver modules (HDMs) group devices together using a protocol, such as the SCSI-3 protocol, meets the limitation of "adding a storage protocol to the logical disk object using a derived disk object in response to a user protocol selection." Ans. 11.

For the reasons discussed in connection with claim 1, we find that Lagueux does not teach "creating a logical disk object" and "creating a virtual disk object." The LUNs may be a "logical" disk object or a "virtual" disk object representing physical storage, because the terms "logical" and "virtual" can be broadly interpreted outside of the context of the claim. However, we find no teaching in Lagueux of the claimed invention of creating a virtual disk object from a logical disk object where the logical disk object represents the physical storage, i.e., "virtual" and "logical" are

given specific meanings in the claim. The Export Table in Table 1 maps addressing information received with a storage transaction to a virtual circuit, where the addressing information used is the initiator ID, the target LUN, and the target address. Col. 16, ll. 55-60. A virtual circuit is a configured data path that includes a set of driver modules. Col. 2, ll. 15-17. This is a logical representation of the physical storage. The LUN is not created from a logical disk object.

We agree with Appellants that the Examiner's reference to columns 2 and 3 provides no explanation of how these columns meet the limitation of "adding a storage protocol to the logical disk object using a derived disk object in response to a user protocol selection." The further explanation in the answer that there are protocols does not explain specifically how storage protocols are added to a logical disk object, a LUN or a virtual circuit, in response to a user protocol selection.

Accordingly, we conclude that Appellants have shown error in the Examiner's finding of anticipation.

Conclusion

Lagueux does not describe "creating a logical disk object . . . , wherein the logical disk is an abstract representation of physical storage capacity provided by plurality of physical stores," "adding a storage protocol to the logical disk object using a derived disk object in response to a user protocol selection," "a presented disk object," and "creating a virtual disk object comprising the logical disk object, the derived disk object and the

presented disk object" as recited in claim 17. The rejection of claim 17 and its dependent claim 18 is reversed.

CONCLUSION

The rejection of claims 1-8 and 13-18 under 35 U.S.C. § 102(e) is reversed.

The rejection of claims 9-12 under 35 U.S.C. § 102(e) is affirmed.

Requests for extensions of time are governed by 37 C.F.R. § 1.136(b). *See* 37 C.F.R. § 41.50(f).

AFFIRMED-IN-PART

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